

Strain-induced Pockels effect in silicon waveguides

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With the increasing demand of data, current chip-scale communication systems based on metallic interconnects suffer rate limitations and power consumptions. In this context, Silicon photonics has emerged as an alternative by replacing the classical copper interconnects with silicon waveguides while taking advantage of the well-established CMOS foundries techniques to reduce fabrication costs. Silicon is now considered as an excellent candidate for the development of integrated optical functionalities including waveguiding structures, modulators, switches... One of the main challenges of silicon photonics is to reduce the power consumption and the swing voltage of optical silicon modulators while increasing the data rate speed. However, silicon is a centrosymmetric crystal, vanishing the second order nonlinear effect i.e. Pockels effect which is intrinsically a high speed effect. To overcome this limitation, mechanical stresses on silicon to break the crystal symmetry can be used depositing a strained overlayer.

In this work, we have studied the effect of the stress layer in the modulation characteristics based on Mach-Zehnder interferometers. The deposition of silicon nitride as the stress layer and its optimization to induce the maximum effect will be presented.